It may not have been Orville Wright's first flight, but to Paul Dye, a lead flight director of Space Shuttle Operations, the moment was filled with the same kind of magic.

A 'bird' of a different feather

by Catherine E. Borsché

On Oct. 9, Dye took his home-built, kit airplane for its first spin around Houston-area skies. This plane, the RV-8, is a favorite among aviators due to its nimble flying and handling qualities. The flight in the RV-8 was not a disappointment, as Dye said that it flew like "a scalded cat."

"It was an exciting morning, with lots of first-flight jitters, but in the end, everything worked out," Dye said. "[Astronaut] John Young [the first person to fly in space six times from Earth] once said, 'if you're not a little nervous before taking up a new aircraft, you obviously don't understand what you're doing.'"

Flying an aircraft that Dye built with his own hands was the culmination of a very early childhood dream.

"Well, according to my mother, I said my first word when I looked up at a plane in the sky, pointed, and said 'airpoo.' So I guess I've always had a fascination for planes," Dye said.

A self-proclaimed "hangar rat," Dye tinkered on airplanes as a kid and started flying at the age of 13. Although he always imagined he would be working on airplanes as a career, his life's path led him to NASA. Now, as lead flight director, his job requires him to get even bigger "birds" up in the air.

A lot of blood, sweat and tears goes into making an airplane from the nuts-and-bolts beginning. As Dye indicated, he will no longer be showing up to work "with scraped and scarred hands from working with aluminum every night." Dye spent over a year assembling the various kits to form the skeleton of the plane. After that, there was still the task of finding an engine and the electronics to complement the entire system.

NASA JSC2006E00843

Paul Dye, a lead flight director of Space Shuttle Operations, next to the RV-8 kit plane he built from scratch.

NASA JSC2006E00842

Paul Dye's RV-8 aircraft gets ready to take off for the first time.

"Even though there's a kit for the airplane, no two are ever alike," Dye said. "This airplane is a favorite because it is so close to an ideal of what an airplane should be. It is an exceptionally fine flying machine."

Building the RV-8 has also allowed Dye to share his passion with co-operative education (co-op) students at NASA.

"I frequently give presentations to co-ops each semester on my career at NASA. Last spring, I was asked about the airplane project, which was in my garage, and before I knew it, I had 40 co-ops coming over to check it out," Dye said.

That visit only opened the floodgates to more sharing.

"This fall, when I mentioned it at my presentation, I had several students volunteer to help in the Flight Test Program," Dye said. "Thinking back to my own school days as an aeronautical engineering student, I realized that I would have killed to be involved in a real-world Flight Test Program, so I enthusiastically invited them aboard."

The Federal Aviation Administration (FAA) is the government agency primarily responsible for the advancement, safety and regulation of civil aviation. Once the plane's construction was complete, the FAA awarded the craft an Experimental Airworthiness Certificate. With this designation, Dye's plane could undergo flight testing to certify it for normal service.

During the flight test period, Dye and the co-ops met every couple of weeks and had brown-bag lunches together. In addition, they went to the airport with Dye to help gather flight measurements. As Dye flew test flights, the co-ops recorded the data and helped produce test flight results.

"It was a great collaborative effort, and I think I enjoyed teaching them the process as much as they enjoyed learning," Dye said.

Now that the aircraft is complete, all that it is lacking is a custom paint job, which Dye is hesitant to do soon since it means he won't be able to fly it during that time.

Getting his own "bird" off the ground, to Dye, was an emotional experience that rivaled his participation with the ascent entry team during the launch of STS-26, the first shuttle flight after *Challenger*.

"This has been a project beyond description—building and flying my own airplane, after all the years I have put into aviation," Dye said. "Words fail me."

NASA JSC2006E00841

View of the cockpit inside the RV-8.

...I said my first word when I looked up at a plane in the sky...

Fueling the fire

by Kendra Phipps

It's got to be hard to spend years toiling over a project and then watch it plummet into flames. Oddly enough, that represents a good day for thousands of External Tank Project Office employees.

When a space shuttle external tank disintegrates in the atmosphere during reentry, that means that it has done its job of supplying the shuttle propulsion system with fuel and helping the spacecraft reach orbit. Its work is finished.

Not so for the tank project employees at Marshall Space Flight Center in Huntsville, Ala., and at the Michoud Assembly Facility in New Orleans. Their work continues before, during and after each shuttle launch—building, processing and testing a nearly constant cycle of external tanks.

"It takes hundreds of thousands of man-hours to process a single tank," said Steve Holmes. Holmes is the team lead for the project office's materials group. He said that Michoud is capable of processing about 12 tanks at a time. The facility, operated by prime contractor Lockheed Martin, used to deliver around six tanks per year, with each tank taking two years to go through the entire process.

Though the revolving door of tanks has slowed recently—tank elements were improved and adjusted following the *Columbia* accident, and more adjustments are currently being considered—the teams continue to give their all.

Inside the Vehicle Assembly Building, the redesigned external tank used on Return to Flight mission STS-114 waits in the transfer aisle after its move from the barge in the Launch Complex 39 Area Turn Basin.

NASA JSC2005E00502

The checklist for processing a tank for spaceflight would be nearly as long as the 154-foot tank itself. An external tank has three major elements: the oxygen tank, the hydrogen tank and the collar-like intertank connecting them. All three components require lots of attention before the whole thing can be shipped to Kennedy Space Center (KSC) for launch.

Some of the processing steps include:

- welding the hydrogen and oxygen tanks, then testing to make sure they can handle the pressure loads
- cleaning the inside and the outside of the hydrogen and oxygen tanks
- applying a corrosion-inhibiting primer
- automatically spraying foam onto the intertank, then machining the entire corrugated structure to achieve a minimized weight while meeting heat protection requirements

Even after the tank is processed and shipped to KSC, the work still isn't done for the tank office. Holmes describes the time surrounding a launch as "exciting but hectic" as final checkouts are performed and Flight Readiness Reviews are conducted. During "tanking," when the tank is filled with 535,000 gallons of liquid hydrogen and oxygen, team members are monitoring valves, heaters and hazardous gas levels and watching for ice formation or any unexpected problems. Then during the launch itself, a close eye is kept on pressurization systems and possible debris during ascent.

Workers at Marshall, Michoud and Johnson Space Center all collaborate on these observations to ensure that nothing is overlooked.

"That's what we have to do; every launch is different," Holmes said. "Some of them, you have absolutely no problems and everything's fine; other times you have cracks or ice that you have to go work on."

The process of manufacturing and monitoring an external tank is intricate enough on its own; adding a hurricane or two only complicates things further. Many of Michoud's 2,000 employees were displaced by Hurricane Katrina, and the facility was isolated by floodwater and debris for several days. Michoud also sustained roof damage, a power outage and additional minor damage from Hurricane Rita.

Despite the upheaval of losing their homes, Holmes said that employees continue to push forward in support of future shuttle missions.

"At times, there's a sense of being overwhelmed with all this," he said, "but on the other hand, sometimes it's beneficial to come to work and get their minds on something else."

Associate Administrator for Space Operations Bill Gerstenmaier also praised the resolve of the employees.

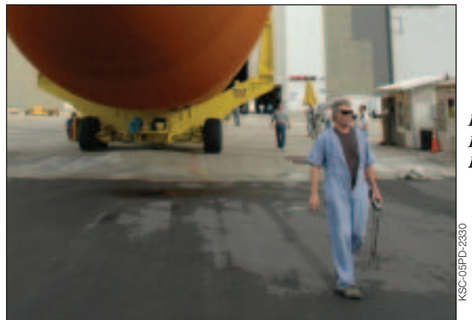
"Workers at Michoud have just done a phenomenal job," Gerstenmaier said. "They've shown tremendous dedication and a tremendous desire to show up to work to help us out."

About 90 percent of the Michoud workforce was back on the job as of early November. Efforts are being made to ensure that the workforce is not overburdened during this understandably stressful time, Holmes said.

Amid all the technical tank checklists and weather-induced drama, Holmes had no trouble defining his favorite part of working with the external tank office.

"By far, the people at Marshall and at Michoud are the best part," he said. "There's not a better bunch of people anywhere."

For more information on space shuttle external tanks, go to: **http://www.nasa.gov/returntoflight/system/system_ET.html**



External tank #120 moves out of NASA Kennedy Space Center's Vehicle Assembly Building (behind it).

KSC-05PD-2330

quick facts

The external tank is 27.6 feet wide and 154 feet tall—34 feet longer than the distance of Orville Wright's first flight in 1903. Despite its size, the aluminum skin of the tank is only an eighth of an inch thick in most areas.

The tank is the only component of the space shuttle that is not reused. It is jettisoned approximately 8.5 minutes into the flight.

The combined volume of the external tank's liquid hydrogen and liquid oxygen tanks is 73,600 cubic feet—equal to the volume of nearly six 1,600-square-foot homes.

If all the weld joints in the external tank were laid out in a straight line, they would stretch more than half a mile.

If the foam insulation covering the external tank were spread on the ground, it would cover nearly half an acre.

Empty, the external tank weighs 78,100 pounds; full, it weighs about 1.6 million pounds.

One of the fuels contained in the external tank, liquefied hydrogen, is the second coldest liquid on Earth at –423 degrees Fahrenheit.